

Fritz Richard Schaudinn, 1871-1906 *Protozoologist of syphilis*

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One hundred years ago Fritz Schaudinn was born in the small obscure town of Roesiningken in Prussia. The Franco-Prussian War which had just finished had led to the foundation of the German Empire. Schaudinn had just started at the infant school when Charcot, in Paris, was impressing European medical circles with his discoveries in central nervous system diseases, especially multiple sclerosis.

Following a wise and wide curriculum of studies in the Gymnasia of Insterburg and Gumbinnen, Schaudinn matriculated into Berlin University in 1890 at the normal age of 19. While at school he had been thinking about a career in philology, and only later recognized that his abiding interests would be in research into protozoan morphology. What little we know about him shows him as a rather studious young man, of robust physique. He tended to listen rather than hold forth in company and was most temperate in his life and habits. His outstanding trait was his power of observation. This inherent faculty was coupled with a gift for clear exposition in writing and these qualities served him well in his chosen vocation of protozoology. After a successful university career he graduated in 1894 with a Doctorate in Philosophy. The research work for his thesis was based on a description of a new species and genus of marine *Foraminifera*, and this very worthy and successful leap into the unknown life cycles of marine life was a portent of coming events. At the same time, as Schaudinn's researches were progressing, Lister in England was overlapping the young Prussian's work with his own in the same field of protozoology; indeed, both showed independently that diamorphism in *Polystomella crespa* is part of the internal cycle.

In 1897, Schaudinn published in association with Siedlocki a paper on the *Coccidia*, and further research produced the facts on the complete life cycle of *Eimeria schubergi*.

This paper can be quoted as an ideal in research.



FIGURE *Fritz Schaudinn, 1871-1906. From series of portraits published by Deschiens [Courtesy of the Wellcome Trustees].*

The array of facts presented indicated the possession of remarkable technical ability in both eye and hands combined with an intuitive knowledge of what and where to seek, along with a balanced intellectual approach necessary for the interpretation of findings. Most impressive is his careful and precise presentation—truly an exemplary work for modern scientists.

In 1895, on Schaudinn's return from a collecting trip in the Arctic, he published, under combined editorship with Romer, 'Fauna Arctica', a redoubtable work running into four volumes. It is especially noteworthy to point out that this work has stood the test of time—not a single finding has required later amplification; not a single fact has required to be added.

In 1901, the medical world was greatly stirred by the observations of Ross and Grassi on *P. vivax* as

the cause of tertian malaria. Schaudinn was naturally extremely interested in this scientific field and as a result was assigned to work in Rovigo, a small town near Venice, notorious for malaria, to check these results. Over the next 2 years, he (Schaudinn, 1903) further clarified the observations of Ross and Grassi by seeing for himself the entrance into the erythrocyte of the malarial sporozoite, the end-stage of the sexual cycle in the mosquito; and by observing the merozoite, the end-stage of the asexual cycle in man.

For many years there had been considerable controversy in medical circles in Europe and further afield concerning the protozoon *Amoeba coli*. It had been noted by Lambl (1860) and by Lewis and Cunningham (1870) that a species of amoeba occurred in the intestine of patients ill with tropical dysentery. Loesch (1875) described it accurately and named it *Amoeba coli*. In amoebic dysentery, clinicians saw a well-characterized disease and medical workers became convinced of the aetiological relationship of this organism to the disease, but the biologists maintained a sceptical attitude on the pathogenicity of *Amoeba coli*. They defended their attitude strongly, as they showed the presence of an amoeba, no different apparently from *Amoeba coli*, in the intestine of healthy people. Before it could be stated that dysentery was due to an amoeba, the biologists justly demanded morphological differences which permitted distinction between an organism associated with disease and that found in the healthy gut.

It remained for Schaudinn to describe these differences and to name the species found only in dysentery, *Entamoeba histolytica*. The other, found in healthy people and commented on by Loesch, he called *Entamoeba coli*. It was now apparent to clinicians, pathologists, and biologists that protozoal study was of the greatest importance and a science of great value to medicine. Schaudinn became aware that protozoology was now a major branch of zoology and saw the contributions to the literature of the subject reach such numbers that they demanded a publication devoted to them alone, and this journal, the *Archiv für Protistenkunde*, he founded in 1903.

After completing the malarial studies in East Italy, where he had freed the village of St. Michele di Leme from endemic malaria by prophylactic treatment with quinine, he returned to Berlin and began an investigation into the modes of infection in ankylostomiasis. Clinicians had drawn his attention to patients, mainly agricultural workers and miners, affected by this hook worm which had already been identified by Looss. Its mode of entrance into the body remained a mystery. By experiments on monkeys, Schaudinn established beyond controversy that the larvae could penetrate normal skin and give

rise to hook-worm disease. He opened the field for extensive preventive and public health measures leading to this deadly disease becoming a comparative rarity.

As a reward for this patient, exacting, and valuable work he was promoted, in 1904, at the age of 32, to be Head of the Department of Parasitology in the Department of Zoology of the University of Berlin—the youngest scientist of his time ever to hold such a responsible post. This honour represented wide recognition by leading scientists in Government circles of their debt of gratitude for his epoch-making studies in hook-worm and amoebic infestations as well as malaria.

The cause of the great scourge of syphilis had been perplexing and baffling scientific investigators for many years. As far back as 1878, Edwin Klebs, the redoubtable bacteriologist, had attempted to transfer syphilis to higher apes but these animal studies were not microscopically conclusive (Klebs, 1878). They none the less led the way for Metchnikoff and Roux, at the Pasteur Institute in Paris, who published papers proving that syphilis had been definitely transferred to apes by them—although they did not succeed in finding the agent causing the infection (Metchnikoff and Roux, 1903, 1904).

The foremost medical and scientific workers in France and Germany were now competing in an all-out race to discover the identity of the organism; the odds were slightly in favour of the German workers using the new model of the Zeiss microscope. On February 2, 1905, Professor Schulze, the Director of the Institute of Zoology at the University of Berlin, announced that Dr. Siegel, an assistant in his Department, claimed to have found protozoa in lesions of primary syphilis and in the blood of syphilitic patients. These were similar to those he had previously described for smallpox and scarlatina! This report was submitted to the Prussian Academy of Sciences. Within days of this report, the President of the Health Institute requested Dr. Schaudinn and Dr. Neufeld (Neufeld, 1905) to investigate at once, along with Dr. Erich Hoffman, a very capable young dermatologist and syphilologist from the University Dermatological Clinic.

On March 3, 1905, joint study was commenced and fine spirochaetes were found by Schaudinn in a fresh unstained smear of tissue juice from a secondary stage papule. It is emphasized that, although Schaudinn saw *Spirochaeta pallidum* on March 3, he did not claim on that day that it was the organism causing syphilis. Indeed he was very cautious at this stage, having seen that Siegel's protozoa (which Siegel had named *Cytorrhycetes luis*) were not the causative organisms of syphilis but were sapro-

phytes. Schaudinn's findings were summarized thus in a report to the Health Institute on March 20:

'Many organisms had been found and certainly protozoa were among them. A general problem must be solved, the study of the protozoon fauna of man about which there is at present little knowledge. This study is important for the critical interpretation of disease-causing organisms. Siegel deserves appreciation for his work, if only for the fact that it has attracted the attention of other investigators'.

Further investigations were undertaken by Schaudinn on specimens from a syphilitic lymph node submitted by Hoffmann, and stained by Giemsa. A few spirochaetes were found and photographed. Schaudinn now felt that the recognition of *Sp. pallidum* in the lymph node was the real discovery of *Sp. pallidum* as the cause of syphilis, and on April 6 a joint publication detailed their findings (Schaudinn and Hoffmann, 1905).

As a result of his investigations into several species of spirochaetes, he concluded that they were protozoa and closely related to trypanosomata: he could not demonstrate an undulating membrane for *Sp. pallidum*. At that time there was no dark-ground illumination technique as we know it today, but despite his limited means of studying morphology, Schaudinn realized that this was a new genus and there and then christened it *Treponema*.

On May 17, 1905, Schaudinn and Hoffman, at a meeting of the Berlin Medical Society, gave a microscopical demonstration of *Treponema pallidum* and other spirochaetes, showing the morphological differences and staining qualities. Both very cautiously stressed that although they were not yet in a position to state categorically that *T. pallidum* was the cause, yet it was found in primary syphilis, in secondary papules, in a lymph node, and in the blood of syphilitics.

A thorough and objective study of the pertinent literature leaves no doubt that Fritz Schaudinn was the first to see *T. pallidum*, but to Hoffmann goes great credit for his relentless work on the investigations following Schaudinn's discovery, and in proving this protozoon to be the cause of syphilis.

By a cruel stroke of fate, Schaudinn was prevented from knowing the far-reaching effects of his labours and discovery. His untimely death occurred on June 22, 1906, at the age of 34. Into his short life-span he had crowded a wealth of great achievement and it is difficult to believe that his working life in science was little more than 10 years. As a young man widely known as a tireless worker, the quality of his research had elevated him head and shoulders above the scientists of his day, and by his death the world lost a brilliant worker and original thinker. Schaudinn's dynamic colleague, collaborator, and well-loved friend, Hoffmann, lived until 1959, and enjoyed the good fortune of seeing and participating in immense progress in syphilis research and treatment.

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